→ John LaPadula

FACT SHEET: SHIELDALLOY BRIEFING WITH NJ DEP

A meeting was held on April 3, 1990 to discuss the radionuclide contamination at the Shieldalloy site of Newfield, NJ. Attending participants from the US EPA and NJ DEP included individuals from respective Superfund, Radiation and Legal Counsel branches.

Florie Caporuscio (EPA) presented evidence which will be used by Donna Gaffigan (lead project contact,DEP) to determine materials, locations, and environmental pathways which Shieldalloy must sample both on-and off-site. A further issue was discussed pertaining to the use of Rare Earth Element (REE) analyses. It was decided that REE determinations should be made of unprocessed ore, all slag piles and lime piles. This chemical "fingerprinting" could then be used as a data base to determine whether radioactive material from Shieldalloy has been transported off-site.

A letter will be prepared by Donna Gaffigan on April 4, 1990 to be sent to Shieldalloy. The letter will address the results of the meeting and inform Shieldalloy that such radiological and geochemical analyses of soil, dust, slag, ore, sediments, and water must be included in the company's Work Plan. In addition, a field inspection of the site will be scheduled in the near future to include all members of the meeting.

prepared by : F.A. Caporuscio

Attachment

REVIEW OF SHIELDALLOY OAK RIDGE ASSOCIATED UNIVERSITIES DOCUMENT

Oak Ridge Associated Universities (ORAU) conducted a radiation survey of Shieldalloy Corp., Newfield, N.J. during the time period October 1987 to December 1987 at the request of NRC region I. The document produced (ORAU 88/G-79) was published in July, 1988. Region II of the U.S. Environmental Protection Agency (EPA) has studied the ORAU document and has formed the following review. This report consists of five major portions, which are: 1) ORAU study description, 2) Statement of findings, 3) Issues of concern, 4) Results of review, and 5) Recommendations.

ORAU STUDY DESCRIPTION

The principle sources of radiation at Shieldalloy are radium (Ra), thorium (Th), and uranium (U). These elements are natural minor elements in the mineral ore pyrochlore, which the company processes to extract columbium (an element used in making steel alloys). Since the pyroclore ore contains more than 2 wt. % Th and 0.4 wt% U, Shieldalloy has applied for and been granted an NRC licence (SMB-743), in accordance with 10 CFR 40.

Pyroclore ore is processed by smelting to obtain columbium, with the Th and U remaining in the slag waste. This slag is stored on-site in Fe-Cb "high-ratio" and "standard" waste piles. Dust from the smelting operations (which contain low levels of radionuclides) are retained in baghouse dust collectors. The dusts are then put into various "lime piles" on site.

The radiation survey by ORAU at Shieldalloy included: monitoring of the site perimeter and soil samples (20 meter intervals), slag analyses, bore-holes for sub-surface soils, well water analyses, sediment and water run-off analyses, settling pond sediment analyses, monitoring of air stacks and baghouse dust.

The ORAU report finds, "evidence of inadequate past practices for segregation and control of some contaminated material. As a result, some plant areas contain concentrations of radionulcides in excess of those which could be released for unrestricted use. There was no evidence of migration of radionuclides into subsurface soil or groundwater".

STATEMENT OF FINDINGS

A. Background Readings. Background exposure rates in the region are 6-8 uR/hr. Soil background determinations were found to be 0.1 - 0.6 pCi/hr for Th; 0.2-0.9 pCi/hr for radium; and 0.3 - 1.3 pCi/hr for U.

B. Site perimeter gamma ray values. At one meter above ground, readings varied from 9 to 103 uR/hr. At soil contact, gamma ray values range from 8 to 412 uR/hr.

C. Site perimeter soil concentrations (highest values)

Th	68.1 pCi/g
Ra	61.9 pCi/g
U	147 pCi/g

D. Fe-Cb Slag pile

1) Average material values (pCi/g)

	high ratio	standard
Ra	69	123
Th	366	516
U	105	202

2) Soils near slag piles (pCi/g)

	average	high
Ra	8.4	128
Th	28.6	437
U	10.5	160

E. The ORAU report states that numerous other locales on site have elevated gamma ray readings, however, values are not given. These locales are within the region of the slag and lime pit dumps, near the Fe-Cb foundry, the pyroclore warehouse, and scattered other locales on site (see attached map).

F. Borehole soils, waters, gamma-ray downhole readings.

1) Six holes have soil determinations where Th 232 is >10 pCi/g. The highest reading is 689 pCi/g. Furthermore, most of these holes have significant readings down to 2.1 meters.

2) Gross alpha readings in water from the boreholes range from near zero to 5.6. Gross beta values range from 2.5 pCi/1 to 124 pCi/1, with one outlying data point at 143 pCi/1 (isotopic study showed that all radiation of outlying data point was from Th only).

3) Gamma ray downhole bore readings indicate that most radiation intensities drop off rapidly in the first two meters.

G. Well Water and Plant Effluent

well water	Alpha < 4 pCi/1	Beta < 33 pCi/1
effluent	Alpha < 3 pCi/1	Beta < 4 pCi/1

ion exchange column water - no significant concentration.

H. Drainage pathways

water run-off — gross alpha < 2.4 pCi/1
gross beta < 9.7

sediments — Th up to 33.6 pCi/g
(at location 1476 m. on perimeter, Th = 20.2 pCi/g, Ra = 24.8 pCi/g)

settling ponds (pCi/1)	Th	U
East	6.4	5.1
West	2.3	10.1

I. Stack Effluents

1). Old baghouse inlet. One sample was measured at a value of 1.1 x 10 -11 uCi/ ml Ra (which excedes NESHAPS limits). All other samples of this location measured range from 1 to 5 x 10 -12 uCi/ml Ra.

2). New baghouse outlet. All samples analyzed at this location were near or below detection limits.

3). Baghouse dust - range of analyses

Th	15 to 77 pCi/g
Ra	5 to 28
U	10 to 27

Precision on uranium analyses is unacceptable. See examples of values in Table 13.

ISSUES OF CONCERN

A. The slag piles and the dirt surrounding these piles are well above background counts and constitute a potential health problem. Since the fine dust from the bag houses also contain elevated radioactivity values, it is believed that a thorough survey and sampling program for the "lime piles" and their base soils is necessary.

isolated hot spots. Furthermore, sample 23 (which is just inside the perimeter fence) has an extremely high reading for such samples. No explanation has been given for this anomolously high value. The ORAU report states that since borehole gamma ray values drop off significantly below 2 meters depth, the elevated subsurface readings are most likely due to ambient radiation from the slag piles.

It is believed that the ORAU report's borehole data analysis is suspect for two reasons. One would expect at least homogeneous borehole values if they were caused by radiation from the slag piles. Second, some borehole data (when values at depth are higher than at the surface, ie. sample 9) suggests that there is significant downward migration of radionuclides into the subsurface soils.

The reports' statement "no contamination migrating into the soil" and the data indicating radionulcide contamination presented in the report are conflicting. The borehole sampling and analysis program should be reviewed and possibly redone to solve the conflict.

C. The Fe-Cb foundry is known to be contaminated and there are many isolated hot spots on the Shieldalloy site. These problem areas must be fully characterized to identify potentially hazardous zones.

D. Radionuclide analyses of the two bag houses is such that one can't make valid comparisons between the two buildings. Isotope data were analyzed after the filters at the new bag house and found to be at or below detection limits. However, no readings of the dust were made before the filters of this facility. At the old bag house, dust measurements collected before the filters exceed NESHAPS regulations. The report assumes this curie value will be reduced by the filters and cites the new bag house data. This comparison is invalid since no measurements were taken before filtering at the new bag house. It is now deemed necessary to measure the stack effluents for the two bag houses both before and after their respective filtering systems.

E. There are 37 perimeter locations that measured radiation values above background. Certainly there is reason to believe that the contamination extended beyond the perimeter fences. A follow-up survey to delimit the off-site extent of these hot spots needs to be done.

F. Elevated gamma ray, Th, Ra, and U values well above background have been measured outside the site perimeters but the transport method is hot well defined. The ORAU report suggests that the contamination is due to surface runoff. No mention has been made of the potential for

aeolian (wind-blown) transport. The data analysis seems to be incomplete. It seems an investigation of the wind-carried radioactive dust at this site is justified.

G. Sediment samples from perimeter location 1476m are very hot and this location borders the swamp that feeds the Hudson Branch river. It would be prudent to study this potential off-site contamination source further.

H. The ORAU report states that off-site drainage paths are not above radiation background levels, however, all 4 drain exits, the southern pond, and the Hudson Branch river are all well above maximum background (3 pCi/g, see Table 13). This conflict can be resolved with further sampling

I. The report has estimated the volumes and total radionuclide activities of the two slag piles, but did not consider the bag house dusts dumped in the four lime piles. Although the dusts are measured to be an order of magnitude less than the slag piles, the lime piles should be calculated for total radioactivity levels also.

J. The uranium (U 238) data sets in Tables 6,7, and 13 are extremely imprecise. The count times, sample weights, distance from detectors, and justification for assuming "secular" equilibrium with Pa 234 should be listed.

K. The analytical procedures for measuring radionuclides are not fully discussed (see Appendix B). One cannot review accuracy and precision of the data without full procedural explanations.

RESULTS OF ORAU DOCUMENT (ORAU 88/G-79) REVIEW

The Shieldalloy corporation of Newfield, N.J. has widespread radionuclide contamination due to the processing of pyroclore ore. The company stores its radioactive slag in an NRC licensed and restricted zone. However,radioactive contamination is widespread throughout the plant site and not confined to the NRC restricted zone. The many individual hot spots scattered within the perimeter of the companie's fences but outside the slag piles (ie, lime piles, foundry) are not well characterized and in some cases not precisely located. Contamination areas outside the perimeter fence are not well described and the data presented was spotty.

In the conclusions of the ORAU document, it is stated that "contamination from site operations is not migrating into the surrounding soils or groundwater." However, existing off-site data contradicts the above statement for sediments, soils, and the surficial waters. In addition, there is also evidence of

groundwater co-mixing with surficial water near the Hudson Branch river due to the fact that the groundwater level is so high.

RECOMMENDATIONS

Since the findings of the ORAU document are at times inconsistent and the site survey is incomplete, further monitoring and delimiting of radioactive plumes is needed. With regard to the Shieldalloy Corp. on-site ground contamination, four points must be considered. First, the lime piles (containing bag house contaminated dust) and their surrounding soils need to be characterized. Such a study should include total radioactivity estimations of the piles, possible escape routes of dust, and potential for leaching into the soil. Second, the Fe-Cb foundry should be monitored for contamination and the potential for health hazards. Third, isolated hotspots within the Shieldalloy site but away from the NRC restricted zone need to be fully characterized. And fourth, there is a need to repeat and expand the borehole soil study to understand inconsistencies in the depth profile radioactive concentrations. This last point would help in determining whether the elevated soil isotope values are due to leaching from the slag and lime piles.

The understanding of contamination of soils and water off-site from Shieldalloy is poorly constrained due to a lack of data. The perimeter ground scan identified hot spots within 10 meters of the site fence but didn't follow up on this survey. It is now important to delimit how large an extent these hot spots extend away from the site. In a similar manner, contaminated sediments at drainage boundaries were identified, but never followed off-site. Monitoring beyond the site limits must be done to understand where this contaminated material is going. A possible extension of this problem is seen in contaminated waters in the swamp and Hudson Branch river south of the site. Only three water samples were previously taken in this area, and it seems evident that a full water characterization program is needed. A preliminary analysis of muds in the marsh may reveal clays that preferentially adsorb the 3 radionuclides (U, Ra, Th) of concern.

The potential for air contamination by radionuclides from Shieldalloy has been given minimal consideration. Testing of air effluents was performed at the new bag house stack outlet and pollution was noted to be at or below detection limits. Pollution from the old bag house stack outlet was judged to be minimal by inference from the new bag house data. This does not appear to be a valid conclusion. It is recommended that both bag houses be analyzed for radionuclides both before and after their respective filters. In this way, data can be compared between the two buildings. In addition, a series of off-site air monitoring stations should be set up to detect not only bag house effluents but also the potential for wind carried particles from the lime piles.

Finally, the approach to data presentation and QA procedures must be questioned. The analytical QA procedures are not fully contained in the ORAU report. Although the ORAU report states that they participate in EPA QA programs, it is not clear that the procedures were used for this analytical data aquisition. The presentation of data on maps of the Shieldalloy facility can be misleading. Two different maps were used in the ORAU document and therefore cross referencing was impossible. It is imperative that all data points, bore hole locations, etc. be plotted on a standardized map.

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